**Chemical and toxicological screening of the Danube river using mobile passive sampling**

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Organic pollutants are often present in the water column at trace concentrations that are difficult to detect when conventional low volume spot sampling of water is applied. We present a novel representative mobile passive sampling approach for screening of trace organic pollutants along the Danube River. The concept was successfully applied in summer 2013 within the Joint Danube Survey 3 [1]. The application of temporally- and spatially- integrative passive sampling approach resulted in samples that provide a representative picture of pollution situation for eight defined stretches of the Danube River.

We used an “active” passive sampling system (APS) for sampling of trace organic pollutants. The uptake principle in the APS remains the same as in classical static passive sampling and the monitoring results can be evaluated using usual passive sampler calibration parameters. The APS system was installed in summer 2013 on board of the expedition ship Argus to obtain enhanced passive sampler uptake rates in order to achieve sufficient sensitivity despite the short time available for sampling. During a typical sampling period of 5 days the ship moved downstream along a defined stretch. The obtained samples contained water pollutants integrated in time and space along that stretch. Samplers were exchanged every 5 days, which resulted in total of eight samples representing eight stretches of the Danube.

Three types of passive samplers were applied: two partitioning samplers for hydrophobic compounds (silicone rubber (SR) and low density polyethylene (LDPE) sheets), and an adsorption sampler for polar compounds based on styrene-divinylbenzene solid phase extraction disks, SDB-RPS Empore disks (ED), respectively. Extracts of passive samplers were subjected to target analysis of a range of organic pollutants and to toxicological profiling by a battery of bioassays, covering several important steps in the toxicity pathway including induction of xenobiotic metabolism, specific and reactive modes of toxic action, activation of adaptive stress response pathways.

Despite the low or sub- ng l-1 concentrations of most organic pollutants present in the free dissolved phase, passive sampling enabled to clearly identify spatial profiles of a broad range of organic pollutants in the water column, including PCBs, organochlorine compounds, PAHs, alkylphenols, selected polar pesticides and pharmaceuticals. In many cases, the integrative character of passive sampling allowed measurement of compounds down to pg l-1 levels where methods based on low volume spot sampling of water applied in the previous Danube survey failed to detect them. Distribution of quantified toxic potentials among two types of samplers (SR and ED) showed that studied endocrine disruptive and oxidative stress potencies were elicited mostly by polar compounds while AhR-mediated potential can be ascribed mostly to non-polar ones.

References:

[1] Vrana B., Smedes F., Rusina T., Okonski K., Allan I., Grung M., Hilscherova K., Novák J., Tarábek P., and Slobodník J., Passive sampling: chemical analysis and toxicological profiling, in Joint Danube Survey 3, I. Liška, F. Wagner, M. Sengl, K. Deutsch, and J. Slobodník, Eds. Vienna: ICPDR – International Commission for the Protection of the Danube River, 2015, 304–315.

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